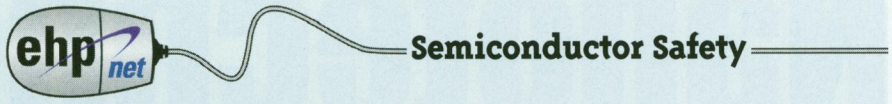
Meanwhile, a team of scientists from Tübingen, Germany, Seattle, Washington, and Keele, United Kingdom, are looking at why mammals alone among vertebrate animals are unable to regenerate damaged sensory hair cells. In a study published in the 30 March 1999 issue of *Proceedings of the National Academy of Sciences*, the team "demonstrates for the first time a molecular mechanism explaining why mammals turn off cell division in the sensory hearing organ," says Hubert Löwenheim, a professor in the Hearing Research Center at the University of Tübingen.

Earlier studies by collaborator Edwin Rubel, a professor of otolaryngology at the Virginia Merrill Bloedel Hearing Research Center of the University of Washington, and colleagues showed that hair cell regeneration in birds actually occurs as a two-fold process. First, so-called support cells, which surround the actual hair cells, must reinitiate the process of cell division, which in most animals normally occurs only during embryogenesis. In the second part of the process, these newly produced cells can then become either new support cells or new hair cells. In mammals, the ability of support cells to proliferate shuts down once the original sensory hair cells are established during fetal development. Rubel says scientists aren't sure why mammals are unable to replace damaged sensory hair cells. "Mammals hear at a much higher frequency than any other vertebrate. Limiting cell division may be a protective mechanism to keep the hearing system tuned to high frequencies," he says.

The team found that the kinase inhibitor $p27^{Kip1}$ is expressed in the supporting cells of the mammalian organ of Corti. In other types of cells, $p27^{Kip1}$ and other kinase inhibitors have been shown to prevent cell division. The scientists used a knock-out mouse model that lacked the gene for $p27^{Kip1}$. Both normal mice and the $p27^{Kip1}$-deficient mice were injected with an agent that marks cells that are undergoing DNA synthesis (as during the process of cell division). In the normal mice, no supporting cell activity was observed, but in the $p27^{Kip1}$-deficient mice, there was evidence that the supporting cells were dividing and developing in postnatal animals, indicating that hair cell regeneration may be achievable in postembryonic mammals.

Both teams are currently planning additional studies to more clearly elucidate the mechanisms involved in hair cell loss and regeneration. For now, these studies provide intriguing clues as to how otologists might someday treat or prevent noise-induced hearing loss.



The seeds of the digital world are microchips—little wafers of semiconducting silicon that can do the work of hundreds of thousands of transistors. Microchips have become ubiquitous through society's demand for devices such as portable phones, fax machines, and computers, and have given rise to the Internet. With the growth of digital technology, though, has come concern over the environmental and health repercussions of the ever-expanding microchip industry. Gases used in the microchip manufacturing process are some of the most potent greenhouse gases known, and workers are faced with potential occupational hazards ranging from high-powered lasers to toxic chemicals.

Microchips are not just causing these problems, however; they are also being used to solve them. Microchip technology in the form of the Internet is being used by groups seeking ways to make the high-technology industry safer and cleaner. The result is Web sites like that of the Semiconductor Safety Association (SSA), located at http://www.semiconductorsafety.org/. This site provides updates on the activities of the SSA, one of the largest groups dedicated to improving the environmental health and safety of the microelectronics industry, and gives visitors instant access to some of the latest innovations and developments in the field.

Environment, health, and safety professionals who access the SSA site may want to start their visit by following the SSA Journal link on the home page. This peer-reviewed journal features research and review articles on subjects such as the latest air monitoring techniques for microchip facilities and the risks associated with using chlorine trifluoride for cleaning manufacturing tools. A search engine is provided that returns citations and abstracts for the journal articles. Information on subscribing to the print version of the journal and on submitting articles is also available on this portion of the SSA site.

The site is also a good place to find information on upcoming events related to the SSA's mission of mitigating the health and environmental impact of the semiconductor industry. Information on SSA conferences hosted by industry groups such as the American Society of Safety Engineers, the American Industrial Hygiene Association, and SEMATECH International are available by following the Upcoming Events link on the home page. The links from this page allow prospective presenters to download calls for papers and to submit abstracts via the Internet.

Similarly, following the SSA 2000 Washington DC Information link will take users to an update on the society's annual International Safety, Industrial Hygiene, Occupational Health, and Environmental Conference. This conference, which is held each spring, features research presentations, courses on recognizing and eliminating hazards, and new product exhibitions.

Besides serving the workers already in the field, the society also works to attract new environment, health, and safety professionals. The Scholarship Programs link on the SSA home page takes users to a description of the opportunities the SSA makes available to graduate students as well as an application form for the program.

The SSA, which was founded in 1978, has well over 1,000 members in 15 local chapters across the United States. These chapters help SSA members keep in regular contact with one another by hosting quarterly meetings and seminars. The SSA Web site also facilitates communication by providing updates on the activities of the chapters and e-mail links to contacts within each. This information can be found by following the Regions/Chapters link on the SSA home page.

In 1983, the SSA branched out to Europe. The SSA Europe link takes visitors to the European group's home page. In October this group will hold its 16th annual conference on the health and environmental issues of the industry near Paris. A description of that conference, directions, and e-mail contacts can be found via the Conferences link on the SSA Europe home page. A description of the 1998 conference is also provided on the European site, as well as a list of publications that can be ordered from SSA Europe.

Both the SSA site and the SSA Europe site provide links to the Web sites of the many regulatory agencies, institutions, and companies involved in semiconductor manufacturing and research. These links can be found under the Sites of Interest link on the SSA Europe page and under the Related Sites and Exhibitor Program links on the U.S. division's page.